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FERNS OF GLACIER NATIONAL PARK, MONTANA[1]

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Glacier National Park embraces an area of 1,534 square miles in northwestern Montana along the main range of the Rockies. The region is extremely rugged and consists of a great mass of abrupt peaks, separated by deep valleys. On the north the Park adjoins Alberta and British Columbia; to the east lie the prairies of the Blackfoot Indian Reservation, and to the west the forests of the Flathead Valley. The Continental Divide traverses the Park. The streams of the west slope reach ultimately the Columbia River, and those of the east slope drain partly into the Missouri River and partly into Hudson Bay.

The highest peaks attain an altitude of little more than 10,000 feet, but the surrounding country is comparatively low—3,170 feet on the west slope and 4,800 feet on the east slope—so that the mountains are quite as imposing in appearance as the more elevated peaks of the southern Rockies. The rocks are stratified and of Algonkian age. They consist chiefly of beds of shale, limestone, sandstone, and argillite, many of which are beautifully colored in red and green.

From a scenic standpoint the region is perhaps unsurpassed in North America. There are more than 60 gla-

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ciers in the Park, most of them small but nevertheless possessing all the features of the largest ones. Great banks of snow persist throughout the summer, often until late in the season even at low altitudes. There are also innumerable lakes, large and small, of beautiful shades of blue and green, some of which are found at high elevations, surrounded by banks of snow and masses of ice. Most spectacular is Iceberg Lake, whose blue surface is covered with huge blocks of floating ice fallen from the bordering glacier. The animal life also is of unusual interest and abundance. Mountain sheep and goats, bear, deer, ptarmigan, and many other mammals and birds can be seen by any visitor.

Not the least attractive feature of Glacier Park is found in the plant life. Flowers are found everywhere in the greatest profusion. Particularly is this true above and near timber line, where the meadows are solid masses of bright color throughout the summer. The heavy coniferous forests, especially those of the west slope, are also of great interest.

The Continental Divide, as is well known, is an important factor in plant distribution, and this fact is strikingly exemplified locally in Glacier Park. The flora of the east slope is that generally characteristic of the mountains of Wyoming and Colorado. The trees are lodgepole and limber pine, alpine fir, Engelmann spruce, Douglas fir, aspen, and black cottonwood. On the west slope the flora shows a close relationship to that of the Pacific Coast. Here we find all the trees which grow on the east slope, and in addition the western white and yellow pines, western larch and hemlock, grand fir, giant cedar, and paper birch. All these are typical Pacific Slope species, and most of them reach the eastern limit of their range here. The herbaceous plants also illustrate the differences between the floras of the two slopes, but not in so striking a fashion. The Pteridophyta,

however, whose species are likely to have a wider distribution than those of flowering plants, are practically the same on both slopes, except in the case of the genus *Lycopodium*, most of whose species are confined, apparently, to the west slope.

Of the life zones recognized by biologists, four are represented in Glacier Park, as follows:

Transition Zone. On the east slope this includes the plains and the narrow strips of land which extend up the creek valleys; also the more exposed slopes of the lower mountains. On the west slope the zone is represented by limited areas of yellow pine timber that lie along the North Fork of the Flathead River. The vegetation of the plains region consists of herbaceous plants, largely grasses, and of a few low shrubs. Pteridophyta are rare; the only ones which really belong in the zone, probably, are *Equisetum arvense* and *Selaginella densa.*

Canadian Zone. This covers the largest portion of the Park, including all of the heavily timbered area. Open hillsides and meadows in the heavy timber are frequent, especially on the east slope. The trees are the species enumerated above, and there is a large representation of shrubby and herbaceous plants. Most of the ferns are found in this zone, and a large proportion of them do not occur elsewhere.

Hudsonian Zone. The Hudsonian Zone is an ill-defined belt about timber line (6,000 to 7,500 feet), which is a transition area between the forests of the Canadian Zone and the meadows and barren slopes of the Arctic-Alpine Zone. The trees are chiefly white-bark pine and alpine fir. These occur mostly as low, stunted, scattered individuals, but they are sometimes assembled in dense thickets. Frequently they assume the "krumholz" form. The species of herbaceous plants are very numerous, but few are confined to this zone. Pteridophyta found here are *Adiantum, Cryptogramma acros-*

tichoides, Athyrium americanum, Polystichum Lonchitis, Filix fragilis, Woodsia scopulina, and *Equisetum arvense* and *E. variegatum.* None of these, except perhaps the maidenhair, is confined to the zone.

Arctic-Alpine Zone. Here belong all the slopes which lie above the last remnants of trees. There are a few low shrubs, chiefly willows, but most of the plants are small herbs, many of them with remarkably brilliant flowers. The vegetation is extremely interesting. A large number of the species represented have a wide distribution in arctic and alpine regions of the Northern Hemisphere. The following Pteridophyta grow here: *Botrychium Lunaria, Asplenium viride, Cryptogramma Stelleri, Athyrium americanum, Lycopodium Selago,* and *Equisetum variegatum.* All of these, except possibly *Asplenium viride,* are found in more or less abundance at lower altitudes.

There seems to be a general belief among visitors to Glacier Park that few ferns are found in the region, but examination of the accompanying list will show that such an impression is an erroneous one. Only a few of the species, it is true, occur in great abundance, but the total number is certainly large for an area of this size in the western United States.

The list of species here presented is based upon a collection made by the writer during the summer of 1919. Nearly ten weeks were spent in the Park, under the direction of the National Park Service, for the purpose of obtaining data concerning the flora. During this time all the portions of the Park usually seen by tourists were visited, and a collection of approximately 4,000 numbers was obtained, representing over 900 species of flowering plants and vascular cryptogams.

The ferns of Montana have been listed by Fitzpatrick[1]. Thirty-seven species were reported, a smaller number

[1] Fern Bull. 12: 97–101. 1904.

than that reported here for Glacier Park. The species listed from Montana but not found by the writer in the Park are *Botrychium Coulteri*, *Asplenium Trichomanes*, *Pellaea glabella*, *Marsilea vestita*, *Equisetum scirpoides*, and *Isoetes Bolanderi*. Of these, the *Botrychium*, *Asplenium*, and *Equisetum* were collected by R. S. Williams at Columbia Falls, only a few miles from Belton, and they are almost certainly to be found in the Park.

OPHIOGLOSSACEAE

Botrychium virginianum europaeum Ångstr. Found chiefly at middle altitudes. The plants are usually scattered and many of them are sterile. The first ones seen by the writer were found by Miss Gertrude Norton in woods about Lake McDermott. Scattered plants were collected later on mossy banks in swampy woods below the lake. In an open bog on a slope along the road near Many Glacier Hotel there must have been hundreds of them, of all sizes. They grew in deep moss under scrub birches and willows, with *Habenaria dilatata* and *Parnassia fimbriata*. On the west slope the plants are often larger than on the east slope. Here they are found in swampy thickets in deep woods. Individuals growing in the open were yellowish green, while those in the woods were deep green.

Botrychium silaifolium Presl. Rare; a few small plants in sphagnum bog at Johns Lake; larger ones along Swiftcurrent Creek below Lake McDermott, in a wet thicket near beaver runs, under willows and *Rhamnus alnifolia*.

Botrychium Lunaria L. Rare; seen only on the east slope; a few isolated plants found on grassy slopes, in bogs, and on mossy banks in deep woods. Collected by Williams at St. Mary Lake. The only locality at which the species was found in abundance was on the moraine at Grinnell Glacier, where there were dozens or hundreds

of the plants, of all sizes, growing on bare soil among rocks, where there was little other vegetation. Probably the plants are not rare at middle elevations, but they are so small and so hidden among other vegetation that they are not easily found.

POLYPODIACEAE

Polypodium hesperium Maxon. Occasional on the east slope at middle or rather low altitudes; infrequent on the west slope; in crevices of shaded argillite cliffs and on mossy boulders in deep woods. The plants seldon occur in any considerable quantity, and in dry places they are small and shriveled. The rhizomes are sweet and have a flavor like that of licorice.

Adiantum pedatum aleuticum Rupr. Not common, but found in several places above or near timber line, in crevices of argillite and limestone cliffs; a few plants found on the west slope at Avalanche Lake, growing in a log jam at the foot of the lake, doubtless carried down by water from some more elevated station. All the plants seen were decidedly small. Their habitat is very different from that of the maidenhair as it is commonly found in the eastern and central states. The plants seem to be almost confined to the Hudsonian Zone, a distribution which must be rather unusual in the western United States. Piper gives the zonal distribution in Washington as Humid Transition and Canadian. Fernald, however, states[1] that the plant is alpine in the Gaspé Peninsula of Quebec, and it appears to be arctic in some portions of Alaska. There is a fine colony of the plants along the cliffs beside the trail just below Iceberg Lake.

Pteridium aquilinum pubescens Underw. Common nearly everywhere in the wooded regions, but usually not extending to the upper limit of timber; in thin or dense woods, in wet thickets, or on open, rather dry slopes. In

[1] Rhodora 7: 190–192. 1905.

open places and in thin woods and thickets the plants are small and yellowish green, while in wet shaded localities they are larger, bright green, and less pubescent. Some of the plants in swamps about Lake McDonald were over five feet high. In late summer the leaves turn yellow or brown.

Cheilanthes siliquosa Maxon. (*Pellaea densa* Hook.) Rare, apparently; found by the writer only on an open slope among loose rocks just above Many Glacier Chalets; collected by Williams in the Lake McDonald region. An unattractive plant, with large loose tufts of brittle leaves.

Cheilanthes gracillima D. C. Eaton. Frequent at middle altitudes, on exposed argillite and limestone cliffs, forming loose tufts. This species has been reported from the Park by Jones as *C. Feei* Moore.

Cryptogramma acrostichoides R. Br. Frequent at middle altitudes, and occasionally extending above timber line; on argillite and limestone cliffs, but most commonly found on rock slides, half hidden among the rocks. Although the plants grow normally in rather dry situations, in excessively dry weather they soon shrivel. They usually form small isolated tufts, which are conspicuous because of the absence of other vegetation.

Cryptogramma Stelleri (Gmel.) Prantl. Occasional above timberline, in crevices of wet shaded cliffs. Here the plants are small and they never occur in abundance. They suggest an immature stage of some larger fern, and are likely to be overlooked. The finest display of this species was seen at Baring Falls, near Going-to-the-Sun Camp. Here, on the overhanging cliffs, which are kept constantly moist from the spray of the falls, there were hundreds of large plants, growing in loose moss, associated with saxifrages and *Mimulus*. The plants have a pale green, sickly appearance. Some of them were attacked by a rust, determined by Dr. J. C. Arthur as *Hy-*

alopsora Cheilanthes (Peck) Arth. Near Grinnell Glacier *Cryptogramma Stelleri* was found in association with *C. acrostichoides.*

Athyrium Filix-femina (L.) Roth. (*A. cyclosorum* Rupr.) The most common fern of the Park, found nearly everywhere in the wooded regions; most abundant in deep moist woods or thickets, but occurring also in thin woods, along streams, in swamps, and on moist open slopes. Probably nine-tenths of the ferns seen in the Park are of this species. In deep woods they often form a dense continuous undergrowth of large interlacing fronds, and on wet slopes, among alder thickets, the plants often cover the ground to the exclusion of most other vegetation. The lady fern is so abundant that one soon comes to look upon it as a weed and to have scant regard for any attractive features it may possess. In favorable situations the fronds are often five feet high. They vary greatly in shape and breadth. In shade they are bright green, but in open places they have a yellowish tinge. In the open the fronds are held more stiffly erect than in protected places. The sori, also, vary conspicuously in form; usually they are merely curved, but those of some plants are horseshoe-shaped. Many of the leaves are covered in late summer with irregular dark spots, which are probably caused by some fungus. The lady fern is often associated with the oak fern, male fern, lace-flower (*Tiarella*), arnicas, twisted-stalk, and red baneberry.

Athyrium americanum (Butters) Maxon. Frequent above timber line; on open grassy slopes, along brooks, on rock slides, and sometimes in cliff crevices. This species is very unevenly distributed; in some places above timber line it is very abundant, in others rare, and in many places absent. It is perhaps the finest fern of the region, and one of the most conspicuous. The fronds are usually about a foot high, and they form mass-

es one to three feet across, which are so dense that there does not appear to be space for the growth of a single additional frond. These clumps are usually surrounded by dense turf or by bare rock, so that they have almost the appearance of having been carefully planted and tended. The leaves always have a fresh, somewhat yellowish green color; they have a slight balsamic odor. This fern is plentiful at Grinnell Glacier and Sperry Glacier and above Lake Ellen Wilson. At Sperry Glacier it is more abundant than elsewhere. Near Sexton Glacier only two or three clumps were noticed, and it was equally scarce between Morning Eagle Falls and Piegan Pass. Near Grinnell Glacier a few plants grew in cliff crevices with the maidenhair. The display of this fern along the trail above Lake Ellen Wilson was particularly striking, for here the great clumps were placed among loose rocks of deep red argillite, which formed a delightful contrast with the pale green fronds.

Asplenium viride Huds. Above timber line at Iceberg Lake and Cracker Lake, in crevices of moist cliffs; collected along the Garden Wall at Granite Park by Miss Gertrude Norton. In a few places this species occurs in some abundance, but it seems to be rare. Our plants are rather small. The fronds lie close against the rocks and are not at all conspicuous.

Polystichum Andersoni Hopkins. Rare; found only at Grinnell Lake and along the upper trail from Many Glacier Hotel to Piegan Pass. In both localities it grew, in some abundance, in dense moist alder thickets on steep hillsides, with the lady fern and male fern. It is a handsome plant, with its fine vigorous fronds held rather stiffly erect. The old withered fronds fall over and persist at the base of the plant. This species has been collected previously only in Washington and British Columbia.

Polystichum Lonchitis (L.) Roth. Frequent at middle altitudes, and often extending above timber line;

usually in deep moist woods, but sometimes found in open places at high altitudes, or on cliffs. Although the holly fern is widely scattered, it is unusual to find more than a few individuals in any locality. It is rather generally distributed on the east slope and at higher elevations on the west slope, but it was not noticed about Belton or Lake McDonald. The plants vary greatly in size. Those of high altitudes are often very small. About timber line they grow mostly under stunted pines and firs and other shrubs, seldom venturing far from some protection. In places plants were seen growing so far back in holes in cliffs that it was difficult to see how they could ever obtain any moisture.

Dryopteris Linnaeana C. Chr. (*Phegopteris Dryopteris* Fée). Common in deep woods of fir, spruce, hemlock, giant cedar, etc.; chiefly at middle altitudes. The oak fern is abundant in many places. Usually it is associated with *Dryopteris Filix-mas* and *Athyrium Filix-femina*, but frequently it grows alone, densely covering mossy banks, or forming a thin ground-cover in the densest forest. The plants are very sensitive to dryness, and in 1919 many of them withered in late summer. Frequently the leaves are disfigured with dark spots, which may be the result of fungus action. The fronds vary greatly in size. It is this species, presumably, which has been reported from the Park by Jones as *Phegopteris polypodioides*.

Dryopteris cristata (L.) Gray. Rare; seen only at Johns Lake (just above the head of Lake McDonald), growing under bushes in sphagnum at the outer edge of the bog. The plants were not very numerous.

Dryopteris dilatata (Hoffm.) Underw. Common at middle altitudes, especially on the west slope; usually in moist woods or thickets or along brooks; sometimes in the less wet portions of sphagnum bogs. This is usually associated with the lady fern, and in general appearance the two are not very conspicuously different.

Dryopteris Filix-mas (L.) Schott. Common at middle altitudes; in deep moist woods or in wet thickets. The plants are large and luxuriant and often make a fine display. They are usually of a deeper green than the lady fern, with which they usually grow.

Filix fragilis (L.) Gilib. Common at all altitudes except the highest; growing in diverse habitats—on shaded or exposed cliffs, on moist banks in woods or along streams, on mossy boulders in woods, and sometimes on rock slides. It is often associated with *Woodsia scopulina*, and some forms of the two species are much alike in general appearance. It is the only fern, except possibly *Pteridium*, which grows about the east entrance. Sometimes the plants are erect, but on cliffs they are often pendent. In dry weather they soon turn yellow and wither. This fern is rather common in moist places above timber line.

Woodsia scopulina D. C. Eaton. Common on the east slope at middle and high altitudes; on the west slope occuring at rather high elevations; growing on cliffs or rock slides. The plants attain their best development on rock slides, where they often form large dense clumps of erect fronds. The stipes persist for many years about the bases of the plants.

Woodsia oregana D. C. Eaton. Collected on rocky hills at the east entrance by Umbach (no. 274). This species is not represented in the collections made by the writer, although there is no reason to believe that it is rare in the region. No attempt was made in the field to distinguish *W. scopulina* and *W. oregana*, but the writer expected that both species would be represented in the rather numerous collections obtained. It may be *W. oregana* is confined to the lower altitudes, where the writer spent little time in making collections.

LYCOPODIACEAE

The genus *Lycopodium* is well represented in the Park, but only one of the species was seen below timber line on the east slope.

Lycopodium Selago L. Local; above timber line just below Sperry Glacier, rather common under bushes and in the shade of rocks; also in similar situations at Gunsight Pass; very abundant at Johns Lake in sphagnum. At Johns Lake the plants grew chiefly under bushes near the edge of the bog, in low mounds of a densely tufted, reddish sphagnum (*S. fuscum*). The species seems to belong to the Arctic-Alpine Zone, for although Johns Lake lies at a low altitude, some of the plants found here (notably *Kalmia microphylla*) grow elsewhere only above timber line.

Lycopodium alpinum L. Found only at Snyder Lake; occurring rather sparingly just at the edge of a rock slide, under blueberry bushes. This species is not known to have been collected in the United States previously. It is considered an Arctic plant, but at Snyder Lake it was growing in the Canadian Zone. When seen from a short distance, it bears a striking resemblance in habit and color to the creeping cedar (*Juniperus horizontalis*).

Lycopodium obscurum L. Seen only near Belton, along the road from the railroad station to Lake McDonald; growing in moss in deep woods of larch, Douglas fir, hemlock, and western white pine.

Lycopodium annotinum L. Common at middle and low altitudes on the west slope, and occasional at middle altitudes on the east slope; in dense woods or thickets. This is the most widely distributed species of *Lycopodium* of the Park, and in some places it is very abundant. Frequently it forms large mats of loose stems. Many of the plants on the west slope are unusually large.

Lycopodium complanatum L. Frequent on the west slope at low altitudes; trailing over the ground in dense

woods. Most of the plants seen were sterile. The species is well distributed about Belton and Lake McDonald, but it does not appear to extend to much higher elevations.

Lycopodium clavatum monostachyon Hook. & Grev. Seen only at Johns Lake, where it is very abundant in moist thickets just outside the sphagnum bog. It is a handsome plant, very different in color and form from our other species.

SELAGINELLACEAE

Two species besides those listed below occur in the Park. The plants are found in open places nearly everywhere on the east slope, at all altitudes, and they occur in greater abundance than in any region known to the writer. Species of *Selaginella* are rare or absent on the west slope.

Selaginella Wallacei Hieron. Common or abundant at low and middle altitudes, and sometimes above timber line, on open, grassy or rocky slopes, on dry hilltops, and in dry meadows.

Selaginella densa Rydb. Common at low altitudes, especially on prairie. On the dry, rocky flats about St. Mary this is one of the most common plants, densely covering large areas of ground.

EQUISETACEAE

Equisetum sylvaticum L. Rare on the east slope, found only in a boggy place in woods at the edge of Lake Josephine, growing with *E. variegatum;* occasional on the west slope at middle altitudes in boggy places in woods. Very different in appearance from any other species; sometimes forming dense tangled masses.

Equisetum arvense L. Common, and often abundant, at nearly all altitudes except the highest; in wet meadows or thickets or along streams and lake shores; frequent on rocky slopes or in wet gravelly meadows above timber

line. Some of the plants found above timber line, especially in the vicinity of snow banks, are nearly prostrate and very sparsely branched. This species is common about the east entrance, extending out upon the prairie. It seems to thrive particularly well upon railroad embankments, and a thick stand of the plants is often seen growing from dry gravel and cinders.

Equisetum litorale Kühl. Occasional at low altitudes, in wet ground or boggy thickets.

Equisetum palustre L. Rare, apparently; a few plants at Belton in sand along the river.

Equisetum variegatum Schleich. Common, especially at middle altitudes and above timber line; about pools, on lake shores, along streams, and in wet meadows or thickets, often in sand or gravel. It is especially abundant in the meadows above or near timber line, and frequently forms dense, almost pure stands of decumbent or ascending stems. Often it is seen growing up to the edges of snow banks. Sometimes it occurs about cultivated ground at low altitudes.

Equisetum fluviatile L. Frequent at low and middle altitudes; in marshes, bogs, or swamps; in sphagnum bog at Fish Lake. The stems are long and weak and occasionally prostrate. In the marshes along Swiftcurrent Creek below Lake McDermott this species is very abundant, growing in shallow water and forming dense pure stands. The stems are of a deep bright green, and at a short distance they strongly suggest those of *Scirpus occidentalis*.

Equisetum praealtum Raf. Occasional at low altitudes, in willow thickets or on rocky lake shores.

Equisetum kansanum Schaffner. Found only at the foot of Sherburne Lake, along a small gully in aspen woods.

Equisetum hyemale L. Common at low altitudes, in swamps or wet thickets; occasionally found on open, well-drained banks.

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